# Description

# MULTI-STAGE RESPIRATOR FILTER WITH TIM FILTER OPTION

## CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a divisional of U.S. Patent Application Serial No. 10/257,801, filed ~~October 15, 2002,~~ *JUNE 23, 2003 NOW PATENT 6,860,267* which claims priority on International Application No. PCT/ US01/12545, filed April 17, 2001, which claims the bene- fit of U.S. Provisional Application Serial Number 60/198,012, filed April 18, 2000.

## BACKGROUND OF INVENTION

## FIELD OF THE INVENTION

[0002] The invention relates to gas mask filters. In one of its as- pects, the invention relates to a gas mask with removable filtration cartridges. In another of its aspects, the inven- tion relates to multi-stage filtration cartridges with an op- tional TIM filter. In another of its aspects, the invention relates to a gas mask with twist and lock removable filtra-

selectable depending on contaminant conditions, and filter 14 is effective, without supplement, in many hostile environments. Filter 20 is disclosed as an axial-flow filter, but a radial-flow filter is also contemplated. Filter 20 includes an outer case 47 enclosing a first, particulate layer 48 and a second, ~~sorbent~~ *adsorbent* layer 50 separated by a permeable membrane 49. Filter 20 further includes an inlet face 51 having a central inlet opening 52, and an outlet face 53 having a central outlet opening 54. The inlet and outlet openings 52, 54 are fluidly connected through the first and second layers 48, 50 and membrane 49. A second twist-and-lock connector (not shown), is used to releasably mount filter 20 to filter 14 and to form a fluid-tight seal between the outlet opening 54 of filter 20 and the inlet opening 36 of filter canister 14.

[0045] As the filter canister 14 is drawn toward the mask housing 12 by the twist-and-lock connector, the projection 22 bears against the plug 64, overcoming the bias of the spring 28 and opening the seal between plug 64 and the seating 66. FIGS. 2-4 illustrate the self-sealing mechanism 16 in the open position, wherein the canister 14 has been mounted on the inlet port assembly 16 and the projection 22 has depressed the plug 64 against the bias of